

A Review on Tacit Knowledge Concept: Reinterpreting Polanyi

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Abstract: In this paper Polanyi's Tacit Knowledge concept is analyzed, in order to clarify the reasons that lead posterior follower researchers to take opposing positions regarding Theory of Knowledge. The paper makes a comparative analysis of the work produced by some of the main exponents on Theory of Knowledge. In this paper three main findings are identified. First, Polanyi's argument encloses an important inconsistency in his argument, which explains why researchers, based all on him, may present totally opposite stands. Second, Theory of Knowledge encompasses two positions, a "knowledge dependent on the knower" strand and a "knowledge independent of the knower" stand. Despite the incongruence in his argument, Polanyi clearly exhibits a "knowledge dependent on the knower" position. Third, the way knowledge is undertaken and managed depends on the posture the researcher takes concerning Theory of Knowledge. This paper contextualizes Polanyi's work in terms of posterior contributions to Theory of Knowledge.

Keywords: Explicit Knowledge, Knowledge, Knowledge Management, Polanyi, Tacit Knowledge, Theory of Knowledge.

I. INTRODUCTION

Knowledge has proven to be a key factor for enterprises [1], [2]. There is a natural interest in them to develop systematic ways to transfer knowledge that is built up based on workers experiences, since this can give particular advantages in a competitive world [3]–[7]. But this is difficult to achieve. Training new workers is not a simple task, and experienced workers can spend more time trying to explain many details that are not easy to notice. Manuals and operator sheets have explicit descriptions of all operations, but many parts are not written down, so the novice worker will have to deal with many trial-error sessions under supervision in order to master a specific task. He will have to develop his own knowledge tacitly. The subjectivity of the matter resides in the fact that most of this knowledge cannot be expressed directly, so the actual knowledge building goes through many explanations on a case by case basis, along with many remarks done by the expert worker which, by the way, are not put down on manuals or operator sheets.

On Knowledge Management field, this kind of knowledge is best known as Tacit Knowledge. The term has been used to refer to knowledge that is hidden in our mind and that is not easily expressed in words. The concept arises from Polanyi's idea that "we can know more than we can tell" [8], which is a further development of his work 'Personal knowledge' [9].

Unfortunately, the argument's development has brought disagreements among researchers in the field, resulting in misinterpretations of the polyanian theory. The predicament involves believing whether or not knowledge is dependent on the knower. Given that both strands form a dichotomy, proposals are to be diametrically opposed to each other.

For the sake of the analysis, we had kept in mind some authors considered to be of importance with diverse postures towards the problem. Yet, we would like to establish that the posture taken demarcates the approach to tacit knowledge.

The discordance between the traditional approach to theory of knowledge and the polyanian theory actually defined should be recalled to point out that Polanyi did not elaborate on any kind of knowledge that stands by itself, but in fact depends on the knower.

II. POLANYI'S DEFINITION OF TACIT KNOWLEDGE

Underneath this argument, Polanyi advocates the firm conviction of knowledge being unmanageable. To uphold his assertions, he draws out a whole theory where knowledge is classified in two kinds: explicit and tacit. As explicit he envisages knowledge as “set out in written words or maps, or mathematical formulae” [11]. On the other hand, tacit refers to “unformulated knowledge, such as we have of something we are in the act of doing” [11].

“The essential logical difference” between explicit knowledge (EK) and tacit knowledge (TK) has to do with the sort of awareness each one is related to [11]. Awareness is defined as “conscious mind” and is strongly linked to self-reflection or inner search [12]. It is divided in two types: subsidiary and focal, linked to EK and TK, respectively. Focal awareness enables critical reflection (a process where knowledge in focal awareness is examined in a critical manner) on knowledge. Whilst, knowledge inside the subsidiary awareness cannot be critically reflected on, because of it not being focused on knowledge in itself, but as a pointer to a meaning. Actually, tacit knowing manifests in the ‘act of understanding’ or providing a meaning: “(...) all meaning lies in the comprehension of a set of particulars in terms of a coherent entity - a comprehension which is a personal act that can never be replaced by a formal operation” [11].

Despite Polanyi’s definition of EK, he did never intend to suggest that knowledge can stand by itself; conversely he considered objects inside the focal awareness to be knowledge only when linked to its subsidiary meaning: “(...) nothing that is said, written or printed, can ever mean anything in itself: for it is only a person who utters something - or who listens to it or reads it- who can mean something by it” [11]. Thus, to mean or understand something it is necessary to resort to TK. This suggests a contradiction to the initial description of EK. However, in his argument, Polanyi begins by providing such definition in order to later delimit it by focal awareness scope.

However, by suggesting that “subsidiary awareness and focal awareness are mutually exclusive” [13] Polanyi contradicts himself: “(...) our attention can hold only one focus at a time and that it would hence be self-contradictory to be both subsidiarily and focally aware of the same particulars at the same time” [13]. If, as previously stated, all knowledge is dependent on the knower and therefore rests on TK, then it is not possible for EK to be independent from TK, neither from the knower. It should be borne in mind that such a misconstruction is rather due to a difficulty in explaining the argument than to the idea itself, as he himself later argues “tacit knowledge is manifestly present, therefore, not only when it exceeds the powers of articulation, but even when it exactly coincides with them” [13].

Besides, Polanyi also submits to utterances accuracy being dependent on the knower: “... nothing that we know can be said precisely; and so what I call ‘ineffable’ may simply mean something that I know and can describe even less precisely than usual, or even only very vaguely” [13]. Which does not inexorably alludes to knowledge inexpressibility, merely that there is knowledge that has not been articulated: “... I shall now regard the unspecifiable part of knowledge as the residue left unsaid by a defective articulation” [13].

In order to illustrate Polanyi’s argument, let us suppose an experienced worker is trying to teach a new worker how to perform a task. According to this theory, knowledge can only be acquired through direct interaction with the knowledge source, whether it be the experienced worker or the task at hand. When knowledge is acquired through direct interaction between the experienced worker and the new worker, those would enter an apprenticeship relationship. Whenever the experienced worker is able to tell what he knows (knowledge within focal awareness, supported by subsidiary awareness) he would be teaching EK. Whenever the experienced worker is not able to tell what he knows (knowledge within subsidiary awareness) the new worker would have to catch this TK through the observation of the experienced worker and the practice of the task. Besides, there would be different levels of descriptions for what the experienced worker could tell, meaning different levels of awareness for different instances of knowledge. For Polanyi, manuals or operator sheets would only be knowledge when focused by the new worker’s focal awareness through reading and linked to its subsidiary, other way, those would just remain information.

Polanyi is said to be widely misread by posterior researchers [10], [14]–[17]. Still, it is mandatory to recognize that inconsistencies are to be found within his argument, which may had misled those researchers into different positions. Polanyi himself is, evidently, influenced by too old and much discussed positions about theory of knowledge. On one hand, there is who envisages knowledge as being independent of the knower [2], [18], [19]. On the other hand, there is who cannot even conceive knowledge without a knower, Polanyi himself, Ribeiro and Busch, among others [8], [11], [13], [20], [21].

III. ANALYSIS OF EXISTING THEORIES OF KNOWLEDGE POSTURES

A. *Virtanen*

In his work, Virtanen remarks that the tacit and explicit distinction of knowledge exposes a clear misinterpretation of the polanyian theory [15], [16], [22], [23]. Polanyi saw both, TK and EK, as fundamental components of knowledge. Consequently, far from suggesting to handle them separately he claims that EK is founded on its TK.

He also states that individuals can only express what they are aware of knowing: for the explicit dimension to manifest, it requires a conscious representation in the mind. Such representation is formed by elements that take part in the subsidiary awareness, which reinforces the idea of both dimensions constituting any instance of knowing.

However, Virtanen also supports the idea of both kinds of awareness being mutually exclusive, and argues that anytime an instance of knowing residing in the subsidiary awareness catches attention, it was switched to the focal awareness [13]. Once an instance of knowledge is placed within the focal awareness, it already forms part of the explicit dimension. To be in the tacit dimension means that a specified instance of knowing is not traceable. Given that all instances of knowing possess TK, regardless of this being in the focal awareness, knowledge that only holds an explicit dimension is unreal [8], [16], [24]. Still, there may be knowledge that does not enclose an explicit part.

Virtanen states that the traditional approach to theory of knowledge, where knowledge is independent of the knower, is inconsistent with Polanyi's original idea of the tacit dimension. Driven by a putative concept distortion, Virtanen proposes an epistemological model to illustrate the structure of knowledge. This model suggests that knowledge must consist of a tacit part on which a potential explicit part is founded.

Going back to the example, according to Virtanen, whatever the experienced workers thinks (focal awareness), which is supported by its subsidiary awareness, form part of EK. Whilst TK refers to knowledge the experienced worker is not consciously aware of possessing, therefore the new worker should have to take a hold of it through observation and practice. Knowledge resides within the worker. Hence, neither manuals nor operator sheets could ever enclose knowledge, given that those would only be knowledge when assimilated by a knowing mind. Ironically, Virtanen's EK and TK are mutually exclusive, which implies that the worker's thoughts (focal awareness) are independent from subsidiary awareness. This is obviously a contradiction, most probably due to Polanyi's theory itself.

While it is true that Polanyi behold TK and EK as part of knowledge, he himself made a clear distinction between both kinds of knowledge. Besides, even when trying to elucidate the polanyian theory, Virtanen does not consider Polanyi's background when writing about such a theory, ending up adopting both standpoints at the same time. Next sections will try to illustrate both perspectives, by analyzing some essays that emerged in response to Polanyi's controversial theory.

B. *Nonaka*

In literature, the dichotomy of knowledge, tacit and explicit, was spread by Nonaka and Takeuchi's theory of knowledge [16]. Nonaka's perspective embraces the "knowledge being independent of the knower" conviction, on which he bases a whole knowledge creation model [19], [25]–[28]. This theory recognizes that both dimensions cannot be separated, enfolding the idea of a continuum [16], where, at one end pure TK is located, and at the other one pure EK is found. It is proposed that knowledge can be converted from tacit to explicit and vice versa by interacting along the continuum.

Within this context, Nonaka provides definitions for both types of knowledge. TK is described as being "tied to the senses, tactile experiences, movement skills, intuition, unarticulated mental models, or implicit rules of thumb" [19]. TK consist in two types: embodied TK and not embodied TK. Embodied TK refers to knowledge that is "tied to our physiology and sensory and motor functioning, but also to our history of physical movement in the world" [19]. On the other hand, the explicit part of the dichotomy settles for knowledge that is "uttered, formulated in sentences, and captured in drawings and writing" [19].

According to Nonaka, tacit knowledge is "acquired with little or no direct instruction, it is procedural and above all, practically useful" [19]. He argues that TK cannot be fully articulated, neither analyzed through self-introspection. That is because a considerable part of it is embodied, besides not being consciously activated.

The interaction between tacit and explicit knowledge along the continuum enables individuals to generate both types of new knowledge. This process of knowledge conversion is described in the SECI model, which incorporates four phases known as: socialization (tacit-tacit), externalization (tacit-explicit), combination (explicit-explicit), and internalization (explicit, tacit) [19], [25], [27], [29].

In this theory, instances of knowing within the worker's mind are considered to be TK. Whilst, books, manuals, and so on are treated as EK. Thus, the experienced worker's TK can be converted into manuals (EK), which the new worker can take advantage of and assimilate to integrate in his own TK. Moreover, the new worker can also make use of direct contact techniques to catch up to knowledge of the experienced worker, such as conversation, observation, etc. As mentioned above, Nonaka clung onto the 'knowledge independent of the knower' position. In consequence, he takes instances of knowing from both the subsidiary and focal awareness as part of TK, and information as part of EK.

C. Busch

Busch [20] adopts the position where knowledge is dependent of the knower based on the contributions made by other researchers in the field, without immersing himself into the controversy of knowledge nature. However, we should recognize his effort to formalize and therefore delimitate tacit knowledge concept by identifying the inter-dependence and overlapping hierarchies between the elements of knowledge.

His work addresses the challenge of providing a formal definition of 'tacit knowledge', which facilitates bringing out a mathematical representation of the concept. He alleges having added the dimension of the human mind to knowledge by taking into consideration some of its characteristics, such as: intent, purpose, values, beliefs, notions of commitment, intelligent behavior, and wisdom [20].

Within the formalization, it is claimed the existence of data (D), information (I), knowledge (K), tacit knowledge (TK), articulable tacit knowledge (aTK), inarticulable tacit knowledge (iTK), Wisdom (W), among others. Those concepts are later used to create a representation, which denotes the relation between them.

D. Collins

Driven by the argument that Polanyi himself pointed out that "a distinction between tacit and explicit has to be preserved" [18], Collins immerses himself into the struggle of clarifying and delimiting both terms. As the argument proceeds, it will be made evident that he leans towards the "knowledge independent of the knower" position. He goes beyond research previous made and provides TK with a classification.

According to Collins, opposite to what others may think, it is TK that is dependable on EK, and not the other way around. It is until individuals realize that they can write down their ideas, when they also notice there are things they cannot express. He claims that individuals consider tacit knowledge being complicated to handle, due to their lack of ability to provide proper explanations, and ensures that it has nothing to do with TK being mystical.

Under this theory, EK is defined as "knowledge that can, to some extent, be transferred by the use of strings in the right circumstances" [18]. On the other hand, he states that TK "is that which has not or cannot be made explicit" [18], and mentions some of its characteristics such as it not being transferable through strings and requiring direct contact.

Tacit Knowledge is categorized, based on the reasons it cannot be explained, as strong or collective tacit knowledge (CTK), medium or somatic tacit knowledge (STK), and weak or relational tacit knowledge (RTK).

He conceives RTK as knowledge that can be expressed but, because of diverse reasons, remains untold. However, he mentions that, even though it is expressible, not all RTK can be made explicit at once. This kind of knowledge can be transmitted through metaphors mainly because, other way, it would be too complicated to transfer.

On the other hand, STK is knowledge that "has to do with properties of individuals' bodies and brains as physical things" [18]. Some main characteristics of STK rely on it being transferable through immersion in society, and the impossibility to get hold of it through strings.

CTK is knowledge that cannot be made explicit since it depends on "the way society is constituted" [18]. Knowledge's main characteristic include its acquisition through involvement in society, takes the form of socially sensitive behaviors, and is found in the language of a community.

So far as one can see, Collins falls for the “knowledge independent of the knower” position. Consequently, when an experienced worker tries to teach a new worker a task, he calls TK to what the experienced worker holds consciously in his mind in order to explain the task, whilst whatever he says and uses to illustrate it refers to EK. Besides, a shared language is required for the experienced and the new employer to reach an understanding between them. The more experience the new employee holds on the task to be taught, the briefer the explanation he needs to understand it. If the experienced worker tries to describe a task that indeed depends on corporal movements, it would surely be easier to demonstrate it, and for the new worker to catch it up, by performing than explaining.

E. Ribeiro

Ribeiro basis his work on Collins research, and takes over some of his concepts. Even so, Ribeiro does not share Collins’ posture; conversely he positions himself on the “knowledge dependent on the knower” stance. As a result, he focuses solely on TK arguing that utterances are nothing but representations of knowledge.

Ribeiro classifies TK into three main categories: contingent, somatic and collective. This classification results from analyzing TK’s nature and feasibility to codification. According to his theory, contingent TK (CKT) incorporates TK that is “embedded in the practices of a form of life but is in principle amenable to codification” [21]. Its amenability to codification depends on the level of awareness of possessing it. Somatic TK refers to the “corporeal background that supports or enables a person to perform the physical counterpart of actions’ intentions and to interact with the physical world” [21]. It can only be developed by means of direct contact with the knowledge source. Meanwhile, collective TK makes it possible to “perform actions that call for an understanding of the social context in order for them to be properly performed” [21]. This kind of knowledge is not amenable for articulation, and considering it is impregnated in society, it can only be acquired through socialization.

From Ribeiro’s point of view, EK actually refers to ‘products of knowledge’, and defines it as “anything that can be used by enculturated actors or can be incorporated in machines, software and so forth” [21]. Knowledge resides within an individual’s mind and, whatever comes out from it, are just reifications of human knowledge. He argues that explicitness, as a matter of fact, relates to individuals within collectivity dealing with knowledge successfully.

Ribeiro merely depicts TK’s concepts to then move onto describing a case study. However, he is obviously into the “knowledge being dependent on the knower” stance. Therefore, from his standpoint, knowledge cannot take a physical form. Moreover, TK goes from subsidiary to focal awareness. From his stand, when an experienced worker tries to teach a new worker a task, what he attempts to convey refers to products of knowledge. The experienced worker makes use of products of knowledge to communicate his TK to the new worker.

IV. THEORIES OF KNOWLEDGE POSTURE'S SYNTHESIS

Next, it is worth mentioning the characteristics perceived by different existing stands regarding theory of knowledge based on the researchers reviewed in this work.

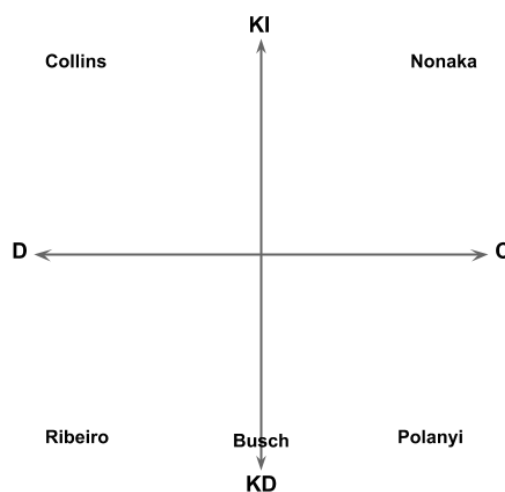


Figure 1: Theories of knowledge postures’ placed within a two-dimensional map, which takes into consideration knowledge dependency on the knower and discreteness.

For scientists who lean toward the “knowledge dependent of the knower” position (KD), all knowledge rests on TK; anything else cannot be called knowledge. While some researchers support the idea of TK being conformed in part by TK amenable to representation and other part that is not, Polanyi sustains that TK is unmanageable. Although this discordance is due to former researchers including both focal and subsidiary awareness in TK, whereas Polanyi attaches subsidiary awareness solely to TK and ascribes focal awareness to EK.

For scientists who believe that “knowledge is independent of the knower” (KI), there are two kinds of knowledge: EK and TK. They conceive TK as encompassing both focal and subsidiary awareness, and EK as composed by utterances. Therefore, for them there is TK that can be accessed through consciousness and TK that cannot be accessed, one corresponding to focal awareness, and other in accordance with subsidiary awareness, respectively.

There is also another main difference between current theories of knowledge, which has to do with knowledge being perceived as a continuum (C) or a discrete (D). Who envisages knowledge as a continuum support the idea of TK and EK interacting along the continuum, whilst others see TK and EK as separated entities that form part of knowledge.

Figure 1 sketches the postures presented above into a two dimensional map. A dimension covers knowledge’s dependency on the knower: knower independent (KI) and knower dependent (KD). The other dimension incorporates knowledge seen as a discrete or as a continuum.

Now, let us illustrate knowledge transference from the four stands taken by the researchers analyzed above with an example. It is necessary to make clear that examples will follow extreme positions. Suppose that a senior manager is concerned with knowledge transference within his company, and so sponsors training on the company’s processes. Aiming to ensure the training quality, trainers have to make sure, and finally evaluate trainees.

For KI-C posture, trainers would carry training out inside a classroom guided by the machinery manuals. Trainers would explain everything that is in the manual in the form of lessons, and would repeat the lesson over and over until, gradually, trainees catch up to, if not everything, at least most of the knowledge intended to be learned. At first knowledge would be too new for trainees just as to understand it, but trainers would expect them to gradually become able to express what they know, and so would evaluate them with a written or oral test.

For KD-C posture, trainers would forget about manuals and concentrate on teaching by practice, so they would rather use the place where the machinery is. They would explain things briefly, and would most make trainees observe them and repeat a sequence of movements that help them manage the machinery. Trainers would expect trainees to learn things little by little, and so trainers would have them repeating movements over and over until mastered. Along with mastering the machinery management, trainees would eventually be able to explain the procedures used. Finally, and as to evaluate, trainers would test trainees’ abilities by a practical examination, while at the same time inquiring them about the procedures learned.

In KD-D case, trainers would also focus on both using the manuals and teaching by practice. Therefore would choose a place where they can make use of the machinery. They would make trainees observe the movements needed to manage the machinery, would make them repeat those movements again and again and would expect trainees to gradually learn them. Because what they are learning has to do with abilities, trainers would not look forward to trainees becoming able to express what they had just learned. In the end, trainers would not consider necessary to make a written test, and would solely evaluate trainees’ abilities by a practical examination.

For KI-D stand, trainers would go through with the training within a classroom, by the use of the machinery manual. Trainers would explain the manual again and again, and expect trainees to eventually learn how to use the machinery by understanding the manual. Given that what has been taught is theoretical knowledge, trainers would evaluate trainees by a written or oral questionnaire.

V. CONCLUSION

In this work an examination of Polanyi’s original inception of Tacit Knowledge concept is presented, which shows to be influenced by hidden postures taken on Theory of Knowledge, that is, whether knowledge depends on the knower or not. Polanyi falls into contradiction when adopting both postures, which causes posterior researchers to present opposed stands even when they reference the same author. Some of the main authors’ positions are exemplified and compared to clarify

their characteristics and differences. On one hand, Polanyi, Ribeiro and Busch exhibit the “knowledge dependent on the knower” stand. On the other hand, Collins and Nonaka fall for the “knowledge independent of the knower” position.

Afterwards, another distinction is made between those who think knowledge is a discreet, and those who perceive knowledge as a continuum. Whilst Polanyi and Nonaka perceive knowledge as a continuum, Collins and Ribeiro envisage knowledge as a discrete. Finally, both distinctions are combined to conform a two dimensional space, where researchers are placed.

Study cases are visualized as future work in order to define which position is best, or in which cases using one specific position is better than using the other one.

REFERENCES

- [1] Abecker, A. Bernardi, and M. Sintek, “Proactive knowledge delivery for enterprise knowledge management,” in *Learning Software Organizations*, Springer, 2000, pp. 103–117.
- [2] T. Davenport and L. Prusak, “Working knowledge: How organizations manage what they know,” pp. 1–15, 2000.
- [3] Park, I. Vertinsky, and M. Becerra, “Transfers of tacit vs. explicit knowledge and performance in international joint ventures: The role of age,” *Int. Bus. Rev.*, Jul. 2014.
- [4] K. S. Kalid and A. K. Mahmood, “A process framework to capture tacit knowledge using storytelling,” *Knowl. Manag. Int. Conf.*, pp. 322–328, 2012.
- [5] M. Mehrvarz and N. Pilevari, “A Model for Evaluating Knowledge Sharing Using Fuzzy Inference System,” 2012.
- [6] L. A. Joia and B. Lemos, “Relevant factors for tacit knowledge transfer within organisations,” *J. Knowl. Manag.*, vol. 14, no. 3, pp. 410–427, 2010.
- [7] S. Wang and R. a Noe, “Knowledge sharing: A review and directions for future research,” *Hum. Resour. Manag. Rev.*, vol. 20, no. 2, pp. 115–131, Jun. 2010.
- [8] M. Polanyi, *The tacit dimension*. Garden City(New York): Doubleday and Company, 1966.
- [9] M. Polanyi, *Tacit knowing: its bearing on some problems of phylosophy (review of modern physics)*. Chicago: University of Chicago Press, 1962.
- [10] K. Schmidt, “The trouble with ‘tacit knowledge’,” *Comput. Support. Coop. Work*, vol. 21, no. 2–3, pp. 163–225, 2012.
- [11] M. Polanyi, *The study of man*. The University of Chicago Press., 1959, p. 102.
- [12] N. Abbagnano, *Diccionario de Filosofía (Actualizado y aumentado por Giovanni Fornero)*, vol. 4. México, D.F.: Fondo de Cultura Económica, 2004, p. 1103.
- [13] M. Polanyi, *Personal knowledge: towards a post-critical philosophy*, 2nd ed. New York: Harper and Row, 1962.
- [14] K. Grant, “Tacit knowledge revisited - we can still learn from Polanyi,” *Electron. J. Knowl. Manag.*, vol. 5, pp. 173–180, 2007.
- [15] H. Tsoukas, “Do we really understand tacit knowledge?,” *Econ. Soc.*, pp. 1–18, 2002.
- [16] I. Virtanen, “In Search for a Theoretically Firmer Epistemological Foundation for the Relationship Between Tacit and Explicit Knowledge,” *Electron. J. Knowl. Manag.*, vol. 11, no. 2, 2013.
- [17] T. D. Wilson, “The nonsense of ‘knowledge management,’” vol. 8, no. 1, pp. 1–33, 2002.
- [18] H. Collins, *Tacit and explicit knowledge*. University of Chicago Press, 2010.
- [19] I. Nonaka and G. von Krogh, “Perspective--Tacit Knowledge and Knowledge Conversion: Controversy and Advancement in Organizational Knowledge Creation Theory,” *Organ. Sci.*, vol. 20, no. 3, pp. 635–652, Jun. 2009.
- [20] P. A. Busch and C. Sciences, “Knowledge Management Implications of Articulable Tacit Knowledge: Case Studies on its Diffusion,” no. March, 2004.

- [21] R. Ribeiro, "Tacit knowledge management," *Phenomenol. Cogn. Sci.*, pp. 1–30, 2013.
- [22] J. S. Brown and P. Duguid, "Knowledge and organization: a social-practice perspective," *Organ. Sci.*, vol. 12, no. 2, pp. 198–213, 2001.
- [23] Hislop, *Knowledge management in organizations: a critical introduction*, 3rd editio. Oxford University Press.
- [24] M. A. Bunge, *Treatise on basic philosophy*. Dordrecht: Springer, 1977.
- [25] I. Nonaka, "The knowledge-creating company," *Harv. Bus. Rev.*, vol. 69, no. 6, pp. 96–104, 1991.
- [26] I. Nonaka, "Managing the firm as an information creation process," *Adv. Inf. Process. Organ.*, vol. 4, pp. 239–275, 1991.
- [27] I. Nonaka, "A dynamic theory of organizational knowledge creation," *Organ. Sci.*, vol. 5, no. 1, pp. 14–37, 1994.
- [28] I. Nonaka, G. Von Krogh, and S. Voelpel, "Organizational knowledge creation theory: evolutionary paths and future advances," *Organ. Stud.*, vol. 27, no. 8, pp. 1179–1208, 2006.
- [29] I. Nonaka and H. Takeuchi, *The knowledge-creating compnay: how japanese companies create the dynamics of innovation*. New York: Oxford University Press, 1995, p. 284.